

Claim Amendments

1. (Previously Presented) A method of controlling thickness uniformity of a film deposited on a substrate in a processing chamber, said method comprising the steps of:

controlling a temperature of at least two distinct locations on the substrate including (i) a perimeter area of a surface of the substrate and (ii) an inner area of the surface of the substrate that is inside the perimeter area of the surface; and

maintaining the temperature of the perimeter area of the surface of the substrate within a range between about 10°C less than the temperature of the inner area to about 20°C higher than the temperature of the inner area; and

depositing the film, wherein the film has a film thickness uniformity less than or equal to about 10%.

2. (Previously Presented) The method of claim 1, wherein

the temperature of the perimeter area of the surface of the substrate is controlled by a first heater element in a portion of the susceptor that is underlying the perimeter area of the substrate, and

the temperature of the inner area of the surface of the substrate is controlled by a second heater element in a portion of the susceptor that is underlying the inner area,

said controlling comprising maintaining the temperature of the perimeter area of the surface of the substrate within a range of about 380°C to about 410°C while maintaining the inner area of the surface of the substrate at about 390°C.

3. (Previously Presented) The method of claim 2, wherein

the film is produced from a precursor comprising TEOS, and

said controlling comprises maintaining the temperature of the perimeter area at about 390°C while maintaining the inner area at about 390°C.

4. (Previously Presented) The method of claim 2, wherein

the film is produced from a precursor comprising TEOS, and

said controlling comprises maintaining the temperature of the perimeter area between about 390°C and about 400°C while maintaining the inner area at about 390°C.

5. (Previously Presented) The method of claim 2, wherein

the film is produced from a precursor comprising TEOS, and

said controlling comprises maintaining the temperature of the perimeter area between about 400°C and about 410°C while maintaining the inner area at about 390°C.

6. (Previously Presented) The method of claim 2, wherein

the film is produced from a precursor comprising TEOS, and

said controlling comprises maintaining the temperature of the perimeter area at about 410°C while maintaining the inner area at about 390°C.

7. (Previously Presented) The method of claim 1, wherein

the temperature of the perimeter area of the surface of the substrate is controlled by a first heater element in a portion of the susceptor that is underlying the perimeter area of the substrate, and

the temperature of the inner area of the surface of the substrate is controlled by a second heater element in a portion of the susceptor that is underlying the inner area,

said controlling comprising maintaining the temperature of the perimeter area of the surface of the substrate within a range of about 350°C to about 460°C while maintaining the inner area of the surface of the substrate within a range of about 340°C to about 450°C.

8. (Previously Presented) The method of claim 7, wherein said depositing comprises depositing on the substrate a film from a precursor comprising TEOS.

9. (Previously Presented) The method of claim 1, wherein said depositing comprises depositing on the substrate a film from a precursor comprising TEOS.

10. (Previously Presented) The method of claim 1, wherein said depositing is by chemical vapor deposition, physical vapor deposition, plasma enhanced chemical vapor deposition or rapid thermal processing.

11. (Previously Presented) The method of claim 1, wherein said depositing further comprises inputting TEOS, He, and Oxygen into a PECVD chamber; and applying RF energy to generate a plasma.

12. (Previously Presented) The method of claim 11, wherein said TEOS is inputted into said processing chamber at about 300 sccm, said He is inputted at about 100 sccm, said oxygen is inputted at about 5000 sccm, and said RF energy is inputted at a power density of about .3 to .7 W/cm².

13. (Previously Presented) The method of claim 12, wherein said depositing is conducted for about one minute.

14-24. (Canceled)

25. (Previously Presented) The method of claim 1, wherein the film is an organosilicate film.

26. (Previously Presented) The method of claim 11, wherein said TEOS is introduced into said processing chamber at a flow rate of about 700 sccm.

27. (Previously Presented) The method of claim 11, wherein said He is introduced into said processing chamber at a flow rate of about 240 sccm.

28. (Previously Presented) The method of claim 11, wherein said RF energy during said depositing provides a power density of about 0.3 W/cm² to about 0.7 W/cm².

29. (Previously Presented) The method of claim 11, wherein said depositing is conducted for about 600 seconds to about 700 seconds.

30. (Previously Presented) The method of claim 1, wherein said processing chamber is a rapid thermal processing chamber, a physical vapor deposition chamber, a plasma enhanced chemical vapor deposition chamber or a chemical vapor deposition chamber.

31. (Previously Presented) The method of claim 1, wherein the substrate is glass or silicon.

32. (Previously Presented) The method of claim 1, wherein the substrate has a length that is greater than 300 millimeters and a width that is greater than 300 millimeters.

33. (Previously Presented) The method of claim 1, wherein the substrate has a length between 550 millimeters and 1.0 meter and a width between 650 millimeters and 1.2 meters.

34. (Previously Presented) The method of claim 1, wherein the film is deposited at deposition rate of about 850 Å/minute to about 1050 Å/minute.

35. (Previously Presented) The method of claim 1, wherein said processing chamber has a power density between about 0.3 W/cm² and about 0.7 W/cm² during said depositing step.

36. (Previously Presented) The method of claim 1, wherein the film is deposited using gaseous materials selected from the group consisting of SiH₄, H₂, N₂, NH₃, PH₃, CH₄, Si₂H₆ and O₂.

37. (Previously Presented) The method of claim 1, wherein the film is metallic or silicon.

38-61. (Canceled)

62. (Currently Amended): A method of depositing a film on a substrate, comprising the steps of:

- providing a susceptor within a process chamber;
- providing first and second heating elements respectively positioned so as to heat first and second portions of the susceptor, wherein the second portion of the susceptor is adjacent the perimeter of the susceptor, and wherein the first portion of the susceptor is radially inward of the second portion of the susceptor;
- providing first and second thermocouples respectively coupled to the first and second portions of the susceptor, wherein each thermocouple produces a temperature reading;
- supporting a substrate on the susceptor;
- supplying a precursor material into the process chamber so as to deposit a film on the substrate;

and

- concurrently with the supporting step and the supplying step, controlling the first and second heating elements so that the temperature reading of the second thermocouple is at least in the range of 10 degrees C to 20 degrees C higher than the temperature reading of the first thermocouple and so that said film has a thickness uniformity less than or equal to ten percent.

63. (Previously Presented): A method according to claim 62, wherein the precursor material includes TEOS.

64. (Previously Presented): A method according to claim 62, wherein the precursor material includes an organosilicate material.

65. (Canceled)

66. (Previously Presented): A method according to claim 62, wherein the controlling step comprises:

- controlling the first and second heating elements so that the temperature reading of the second thermocouple exceeds the temperature reading of the first thermocouple by an amount great enough so that said film deposited on the substrate has a uniformity of thickness less than or equal to 6.7 percent.

67. (Previously Presented): A method according to claim 62, wherein the controlling step comprises:
controlling the first and second heating elements so that the temperature reading of the second thermocouple exceeds the temperature reading of the first thermocouple by an amount great enough so that said film deposited on the substrate has a uniformity of thickness less than or equal to 4.1 percent.

68. (Previously Presented): A method according to claim 62, wherein the controlling step comprises:
controlling the first and second heating elements so that the temperature reading of the second thermocouple exceeds the temperature reading of the first thermocouple by an amount that improves the uniformity of the thickness of said film relative to the uniformity of the thickness of a film that would be produced if the temperature readings of the first and second thermocouples were equal during the supplying step.

69. (Previously Presented): A method according to claim 62, further comprising the step of:
providing a heater controller connected to supply a first electrical current to the first heating element and a second electrical current to the second heating element;
wherein the first and second thermocouples are connected to provide feedback to the controller.

70. (Currently Amended): A method of depositing a film on a substrate, comprising the steps of:
providing a susceptor within a process chamber;
providing first and second heating elements respectively positioned so as to heat first and second portions of the susceptor, wherein the second portion of the susceptor is adjacent the perimeter of the susceptor, and wherein the first portion of the susceptor is radially inward of the second portion of the susceptor;
providing first and second thermocouples respectively coupled to the first and second portions of the susceptor, wherein each thermocouple produces a temperature reading;
supporting a substrate on the susceptor;
supplying a precursor material into the process chamber so as to deposit a film on the substrate;
and
concurrently with the supporting step and the supplying step, controlling the first and second

heating elements so that the temperature reading of the second thermocouple is 10 to 20 degrees C higher than ~~exceeds~~ the temperature reading of the first thermocouple ~~by an amount great enough and~~ so that said film deposited on the substrate has a uniformity of thickness less than or equal to 6.7 percent.

71. (Previously Presented): A method according to claim 70, wherein the controlling step comprises:
controlling the first and second heating elements so that the temperature reading of the second thermocouple exceeds the temperature reading of the first thermocouple by an amount great enough so that said film deposited on the substrate has a uniformity of thickness less than or equal to 4.1 percent.

72. (Previously Presented): A method according to claim 70, wherein the precursor material includes TEOS.

73. (Previously Presented): A method according to claim 70, wherein the precursor material includes an organosilicate material.

74. (Previously Presented): A method according to claim 70, further comprising the step of:
providing a heater controller connected to supply a first electrical current to the first heating element and a second electrical current to the second heating element;
wherein the first and second thermocouples are connected to provide feedback to the controller.

75. (Currently Amended): Apparatus for forming a film on a substrate, comprising:
a process chamber;
a susceptor positioned within the chamber;
first and second heating elements respectively positioned so as to heat first and second portions of the susceptor, wherein the second portion of the susceptor is adjacent the perimeter of the susceptor, and wherein the first portion of the susceptor is radially inward of the second portion of the susceptor;
first and second thermocouples respectively coupled to the first and second portions of the susceptor, wherein each thermocouple produces a temperature reading; and

a heater controller connected to supply a first electrical current to the first heating element and a second electrical current to the second heating element;

wherein the heater controller controls said first and second electrical currents so that the temperature reading of the second thermocouple is ~~at least~~ in the range of 10 degrees C to 20 degrees C higher than the temperature reading of the first thermocouple.

76. (Canceled)

77. (Previously Presented): Apparatus according to claim 75, wherein the heater controller controls said first and second electrical currents so that the temperature reading of the second thermocouple exceeds the temperature reading of the first thermocouple by an amount great enough so that said film deposited on the substrate has a uniformity of thickness less than or equal to 6.7 percent.

78. (Previously Presented): Apparatus according to claim 75, wherein the heater controller controls said first and second electrical currents so that the temperature reading of the second thermocouple exceeds the temperature reading of the first thermocouple by an amount great enough so that said film deposited on the substrate has a uniformity of thickness less than or equal to 4.1 percent.

79. (Previously Presented): Apparatus according to claim 75, wherein the heater controller controls said first and second electrical currents so that the temperature reading of the second thermocouple exceeds the temperature reading of the first thermocouple by an amount that improves the uniformity of the thickness of said film relative to the uniformity of the thickness of a film that would be produced if the temperature readings of the first and second thermocouples were equal during the supplying step.

80. (Previously Presented): Apparatus according to claim 75, wherein the first and second thermocouples are connected to provide feedback to the heater controller.

81. (Currently Amended): Apparatus for forming a film on a substrate, comprising:
a process chamber;

a susceptor positioned within the chamber;

first and second heating elements respectively positioned so as to heat first and second portions of the susceptor, wherein the second portion of the susceptor is adjacent the perimeter of the susceptor, and wherein the first portion of the susceptor is radially inward of the second portion of the susceptor;

first and second thermocouples respectively coupled to the first and second portions of the susceptor, wherein each thermocouple produces a temperature reading; and

a heater controller connected to supply a first electrical current to the first heating element and a second electrical current to the second heating element;

wherein the heater controller controls said first and second electrical currents so that the temperature reading of the second thermocouple is 10 to 20 degrees C higher than ~~exceeds~~ the temperature reading of the first thermocouple and by an amount great enough ~~so that~~ said film deposited on the substrate has a uniformity of thickness less than or equal to 6.7 percent.

82. (Previously Presented): Apparatus according to claim 81, wherein the heater controller controls said first and second electrical currents so that the temperature reading of the second thermocouple exceeds the temperature reading of the first thermocouple by an amount great enough so that said film deposited on the substrate has a uniformity of thickness less than or equal to 4.1 percent.

83. (Previously Presented): Apparatus according to claim 81, wherein the first and second thermocouples are connected to provide feedback to the heater controller.

84. (New): The method of claim 1, wherein the film forms part of a dielectric layer, a semiconductor layer, or a metal layer.